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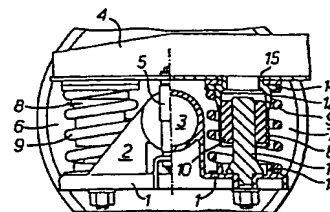
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(54) **Wheelset to frame elastomeric spring units, annular elastomeric elements for use in such units and railway vehicle suspension arrangements incorporating such units.**

(57) A wheelset to frame elastomeric spring unit (8) comprising a rigid core element or pin (11), a rigid sleeve element or pot (12) surrounding and spaced from the pin (11), and an annular rubber element (10) radially compressed and axially elongated between the rigid elements, such that relative axial movement of the rigid elements causes rolling of the rubber element (10) between the rigid elements (11,12). The rubber element (10) is so constructed or arranged that the unit provides different stiffnesses in mutually perpendicular radial directions. The unit is useful as a component of a wheelset arrangement of a railway vehicle or bogie to provide different degrees of restraint against relative horizontal movement between a wheelset member and a frame member in the direction of travel and in the transverse direction.



*FIG. 1.*

WHEELSET TO FRAME ELASTOMERIC SPRING UNITS, ANNULAR  
ELASTOMERIC ELEMENTS FOR USE IN SUCH UNITS AND RAILWAY  
VEHICLE SUSPENSION ARRANGEMENTS INCORPORATING SUCH UNITS.

1                    This invention relates to elastomeric spring  
units for use as components of wheelset to frame  
suspension arrangements of railway vehicles or bogies  
and to annular elastomeric units for use in such units.

5   The invention also relates to wheelset to frame  
suspension arrangements incorporating such units.

                  In particular, the present invention relates  
to a wheelset to frame elastomeric spring unit comprising  
a rigid core element, a rigid sleeve element surrounding  
10 and spaced from the core element, and an annular  
elastomeric element radially compressed between the  
rigid elements.

                  British Patent Specification No. 1,508,632  
(British Railways Board) describes a suspension  
15 arrangement between a wheelset and frame of a railway  
vehicle or bogie, which arrangement has at least one  
suspension unit comprising a coil spring and a rubber  
spring unit acting in parallel between a wheelset  
member and a frame member to provide vertical stiffness  
20 therebetween, the rubber spring unit comprising a single  
annular rubber spring element mounted on a vertical pin secured  
to one of said members and cramped between the surface  
of said pin and another vertical surface carried by the  
other of said members and surrounding the rubber spring  
25 element, so that said rubber ring element forms an  
elongated sleeve on said pin, relative vertical movement  
between said members causing rolling of the rubber  
spring element along said surfaces, the rubber spring  
element providing radial stiffness to restrain relative  
30 movements between said members in a horizontal plane  
(i.e. laterally and longitudinally of the vehicle or  
bogie). The radial stiffness to restrain relative

1 movements between the wheelset and frame members in a  
horizontal plane is the same in all radial directions.  
Whilst it is desirable for the stiffness to be high in  
order to prevent hunting of the unit it is also desirable  
5 for the stiffness to be low for reduced rail wear.  
Accordingly, this prior unit compromises the stiffness  
required to reduce hunting with the stiffness required  
to reduce rail wear.

It is an object of the present invention to  
10 overcome at least some of the above disadvantages.

According to the present invention, a  
wheelset to frame elastomeric spring unit is  
characterised in that relative axial movement of the  
rigid elements causes rolling of the elastomeric element  
15 between the rigid elements, the unit being arranged  
to provide different stiffnesses in different mutually  
perpendicular radial directions.

A unit according to the present invention  
incorporated in a railway vehicle or bogie may provide  
20 a high stiffness in a direction transverse to rails  
over which the vehicle or bogie is travelling, to reduce  
hunting and/or to improve the steering characteristics of  
a bogie, and a relatively low stiffness in the direction  
of the rails to allow a greater freedom of longitudinal  
25 movement to reduce rail wear.

Thus, the invention enables the designer of,  
for example, a railway vehicle suspension arrangement,  
to incorporate an elastomeric spring unit, with its  
well known advantages of simplicity, cheapness and  
30 minimal maintenance, in circumstances where it would  
be necessary or desirable to provide different degrees  
of resilient restraint against relative movements in the  
longitudinal and lateral directions.

- 1           The different stiffnesses in different radial  
directions can be obtained in various ways, for example:
- 5           i.     The annular elastomeric element  
              may comprise segmental portions  
              of different elasticity.
  - 10          ii.    The annular elastomeric element may  
              comprise segmental portions which are  
              of different cross-section, at least  
              when the element is in an unstressed  
              condition.
  - 15          iii.   At least one of the rigid elements is  
              shaped so that the width of the space  
              between them is different in different  
              radial directions.
  - iv.    A combination of any two, or all, of  
                    i, ii and iii.

            The annular elastomeric element, or at least  
one segmental portion thereof, may be hollow, having  
an annular bore therein. In such a case, the different  
20 cross-sections of different segmental portions referred  
at ii above may be achieved wholly or in part by  
having different bore sizes or shapes in different  
segmental portions. Where the annular elastomeric  
element comprises separate segmental portions the  
25 annular bore may accommodate a flexible split ring, to  
hold the segmental portions together as an aid to  
assembly and to ensure that in use the segmental  
portions do not become axially displaced.

            The present invention also includes an annular  
30 elastomeric element for use in a wheelset to frame  
elastomeric spring unit according to the present  
invention.

            According to another aspect of the invention,  
a wheelset to frame suspension arrangement of a railway  
vehicle or bogie has at least one suspension unit

comprising a main spring and an elastomeric spring unit according to the first aspect of the invention acting in parallel between a wheelset member and a frame member, the rigid core element being secured vertically to one of the said members and the rigid sleeve element being secured vertically to the other of the said members, the elastomeric spring unit providing radial stiffness to restrain relative movements between the said members in a horizontal plane, which stiffness is different in the direction of travel from the stiffness perpendicular to the direction of travel.

The terms "vertically" and "horizontal" do not exclude such departures from the strict vertical or horizontal as occur in normal railway operation.

Some embodiments of the invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is an elevation, partly in section, of part of a railway vehicle bogie wheelset to frame suspension arrangement incorporating an elastomeric spring unit embodying the invention;

Figure 2 is a plan view of one form of elastomeric element;

Figure 3 is a side view of the element shown in Figure 2;

Figure 4 is a plan view of a second form of elastomeric element;

Figure 5 is a side view of the element shown in Figure 4, with the right half in section taken on line V-V;

- 5 -

Figure 6 is a plan view of a third form of elastomeric element;

Figure 7 is a side view of the element shown in Figure 6, with the right half in section taken on  
5 line VII-VII;

Figure 8 is a plan view of a fourth form of elastomeric element;

Figure 9 is a side view of the element shown in Figure 8, with the right half in section taken on  
10 line IX-IX;

Figure 10 is a plan view of a fifth form of elastomeric element;

Figure 11 is a side view of the element shown in Figure 10, with the right half in section taken on  
15 line XI-XI;

Figure 12 is a plan view of a sixth form of elastomeric element;

Figure 13 is a side view of the element shown in Figure 12, with the right half in section taken on  
20 line XIII-XIII;

Figure 14 is a plan view of a seventh form of elastomeric element; and

Figure 15 is a side view of the element shown in Figure 14, with the right half in section  
25 taken on line XV-XV.

Referring to Figure 1, the suspension arrangement is supported on one of the axle boxes (not shown) of the wheelset by a plate member 1. The plate member 1 has upstanding side walls 2, circular holes  
30 3 being provided in the side walls 2 so that the plate

- 6 -

member can be located over the axle box. A portion 4 of the bogie frame is shown supported on the suspension unit. A conventional damper 5 is connected between the plate member 1 and the bogie frame 4 for damping relative vertical movements.

The suspension unit has two identical spring assemblies 6 and 7 mounted in front of and behind the axle box. Each spring assembly comprises an elastomeric spring unit 8 and a main coil spring 9 acting in parallel between the axle box and the bogie frame. The elastomeric spring unit 8 comprises an annular elastomeric element 10 which surrounds a rigid core element 11 and is surrounded by a rigid sleeve element 12, being radially compressed between these rigid elements. The core element 11 is secured to and projects vertically upwards from the plate member 1, while the sleeve element 12 is secured to and projects vertically downwards from the bogie frame 4. The coil spring 9 locates around the sleeve element 12 and abuts against the plate member 1 at its lower end, the member 1 having an upstanding boss 13 for locating the lower end of the coil spring 9. At its upper end the coil spring 9 abuts against the bogie frame 4 through an external flange 14 on the sleeve element 12 and thus clamps the sleeve element 12 to the bogie frame 4. Location of the sleeve element 12 against displacement in any radial direction is afforded by a cylindrical extension 15 on the sleeve element 12 located in a hole in the bogie frame 4. The outside of the sleeve element 12 serves as a guide for the vertical deflections of the

coil spring 9.

The suspension unit is illustrated in Figure 1 in its condition for vehicle tare load. In this condition the annular elastomeric element 10 is pre-  
5 stressed to a predetermined degree by deformation brought about when fitting it on the rigid core element 11 and within the rigid sleeve element 12. The deformation is such that the annular elastomeric element 10 frictionally grips the surface of the rigid  
10 core element 11 and the inner surface of the rigid sleeve element 12 so that it cannot slip along these surfaces. Thus relative vertical movement between the rigid core and sleeve elements will cause the annular elastomeric element 10 to roll along the  
15 surfaces of the said rigid elements. Also, the degree of deformation produces the desired vertical shear characteristics.

In operation of the suspension arrangement described above, the vertical load is mainly supported  
20 by the coil spring 9 which is designed to give the desired degree of vertical freedom between the bogie frame and the wheelset. The shear stiffness of the annular elastomeric element 10 will contribute to the vertical suspension stiffness, but the proportion will  
25 be small. Vertical deflections are damped mainly by the damper 5, but the elastomeric spring unit 8 may make a small contribution to vertical damping.

As so far described, this embodiment may appear substantially the same as the first embodiment  
30 illustrated and described in the said British Patent



Specification No. 1,508,632. The essential difference resides in the nature of the annular elastomeric element 10. In the said patent specification it is pointed out that the longitudinal and lateral forces  
5 are reacted through the rubber spring unit which maintains a radial stiffness whilst accommodating both static and dynamic vertical deflections. It is further pointed out that whilst the optimum value of the radial stiffness will be different for different vehicles, the same  
10 rubber element can be used on different vehicles to achieve a near optimum radial stiffness. The present invention is based on an appreciation that it is possible, with an elastomeric spring unit, also to achieve different stiffnesses in different radial  
15 directions. The following description discloses several ways in which this can be done, by using different forms of annular elastomeric element.

The elastomeric element 10 shown in Figures 2 and 3, when in its unstressed condition as  
20 illustrated, before it has been forced onto the rigid core element 11 and squeezed into the rigid sleeve element 12, is in the form of a torus or 'O' ring, the same shape as the single rubber ring described in the said patent specification. However, in this case  
25 the ring is not homogeneous but comprises four segmental portions 20, 21, 22 and 23. The portions 20 and 22 are made of a material having a different elasticity from the material of the portions 21 and 23. Thus, the portions 20 and 22 are made of a soft  
30 rubber whereas the portions 21 and 23 are made of a

harder rubber. The elastomeric spring unit would be installed with the softer segments 20 and 22 aligned in the longitudinal direction, i.e. the direction of travel. The shear resistance of the hard rubber segments 21 and 23 which would tend to resist movement in the longitudinal direction is more than counteracted by the lower stiffness in compression of the soft rubber segments 20 and 22. Separate segments can be joined together end to end to make an integral unit, or the element can be formed as an integral unit, the requisite differences in hardness being imparted by differences in treatment in the course of vulcanisation. Although the segments are all shown as being the same size, they could be of different lengths in order to vary the stiffness characteristics of the unit.

In some cases, particularly where only small axial movements are contemplated, the segments 20', 21', 22' and 23' may be formed as separate integers as shown in Figures 4 and 5, and remain so in the spring unit.

The annular elastomeric element need not be a solid body; it could be hollow as shown in Figures 6 and 7 where a segmental annular element has a central bore 25. In this case the different stiffnesses are achieved by using rubbers of different hardness for alternate segments, as in Figures 4 and 5. However, alternatively or in addition, differences in stiffness can be achieved by using bores of different sizes in different segments, or by employing some solid segments and some hollow ones.

Figures 8 and 9 show an embodiment like that of Figures 6 and 7, comprising separate segments with a bore 26, but in this case the segments are threaded onto a flexible split ring 27. The ring keeps the segments in position end-to-end which facilitates assembly of the elastomeric spring unit and reduces the risk of the segments becoming axially displaced in use.

Figures 10 and 11 show an embodiment in which the material of the annular elastomeric element 30 is of uniform hardness, the different stiffnesses in different radial directions being achieved by having segmental portions of different cross-sections. Thus, the segmental portions 31 and 33 are of substantially larger cross-sectional area, and therefore of greater stiffness, than the segmental portions 32 and 34.

Another embodiment which achieves different stiffnesses in different radial directions by variations in cross-section rather than by variations of hardness of the material is shown in Figures 12 and 13. In this case the elastomeric element 40 is essentially a torus in which a pair of outwardly-facing parallel flat surfaces 41 and 42 has been formed externally on diametrically opposite sides.

Figures 14 and 15 show a somewhat similar embodiment, but in this case a pair of parallel flat surfaces 51 and 52 has been formed in the interior of a torus 50.

CLAIMS

- 1 1. A wheelset to frame elastomeric spring unit  
comprising a rigid core element, a rigid sleeve element  
surrounding and spaced from the core element, and an  
annular elastomeric element radially compressed between  
5 the rigid elements characterised in that relative axial  
movement of the rigid elements (11, 12) causes rolling  
of the elastomeric element (10; 30; 40; 50) between the  
rigid elements, the unit being arranged to provide  
different stiffnesses in mutually perpendicular radial  
10 directions.
2. An elastomeric spring unit as claimed in claim  
1 characterised in that at least part of the difference  
in stiffness is afforded by the annular elastomeric  
element (10, 30, 40, 50) comprising segmental portions  
15 (20, 21, 22, 23; 20', 21', 22', 23'; 31, 32, 33, 34) of  
different effective elasticity.
3. An elastomeric spring unit as claimed in  
claim 2 characterised in that the annular elastomeric  
element (10) has at least one hollow segmental portion  
20 (25; 26).
4. An elastomeric spring unit as claimed in  
claim 3 characterised in that the annular elastomeric  
element consists of hollow segmental portions (26)  
defining an annular bore which accommodates a flexible  
25 split ring (27).

1 5. An elastomeric spring unit as claimed in any of  
the preceding claims characterised in that at least part  
of the difference in stiffness is afforded by the annular  
elastomeric element (30; 40; 50) comprising segmental  
5 portions (31, 32, 33, 34) which are of different cross-  
section, at least when the annular elastomeric element is  
in an unstressed condition.

6. An elastomeric spring unit as claimed in  
claim 3 or claim 4, and also in claim 5, characterised  
10 in that the difference in cross-section of different  
segmental portions is afforded at least in part by a  
difference in cross-section of bores therein.

7. An elastomeric spring unit as claimed in any  
of the preceding claims characterised in that at least  
15 one of the rigid elements is shaped so that the width of  
the space between the rigid elements is different in  
different radial directions.

8. A wheelset to frame suspension arrangement of  
a railway vehicle or bogie, having at least one  
20 suspension unit comprising a main spring and an  
elastomeric spring as claimed in any of the preceding  
claims acting in parallel between a wheelset member and  
a frame member, the rigid core element being secured  
vertically to one of the said members and the rigid  
25 sleeve element being secured vertically to the other  
of the said members, the elastomeric spring unit  
providing radial stiffness to restrain relative  
movements between the said members in a horizontal plane,  
which stiffness is different in the direction of travel  
30 from the stiffness transverse to the direction of travel.

9. An annular elastomeric element for use in a wheelset to frame elastomeric spring unit as claimed in any preceding claim.

10. A wheelset to frame suspension arrangement of a railway vehicle or bogie, the arrangement having at least one suspension unit comprising a coil spring and a rubber spring unit acting in parallel between a wheelset member and a frame member to provide a vertical stiffness therebetween, the rubber spring unit comprising an annular rubber spring element mounted on a vertical rigid core element secured to one of said members and radially compressed and axially elongated between the surface of said core element and a vertical rigid sleeve element carried by the other of said members and surrounding the rubber spring element, relative vertical movement between said members causing rolling of the rubber spring element along said surfaces, the rubber spring element providing radial stiffness to restrain relative movements between said members in a horizontal plane, which stiffness is different in the direction of travel from the stiffness perpendicular to the direction of travel.

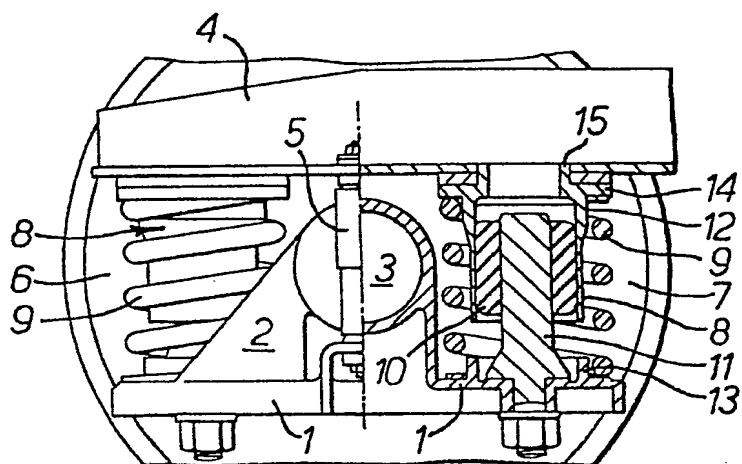


FIG. 1.

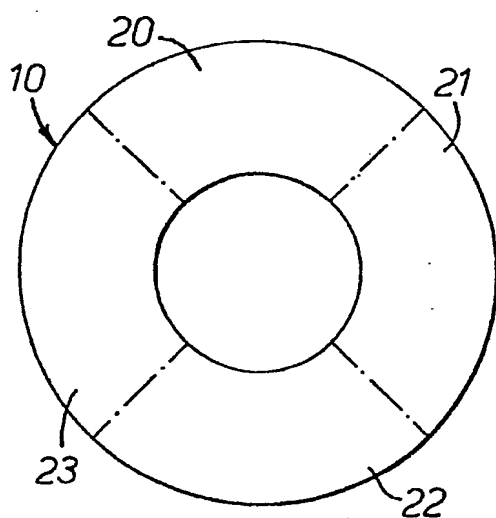


FIG. 2.

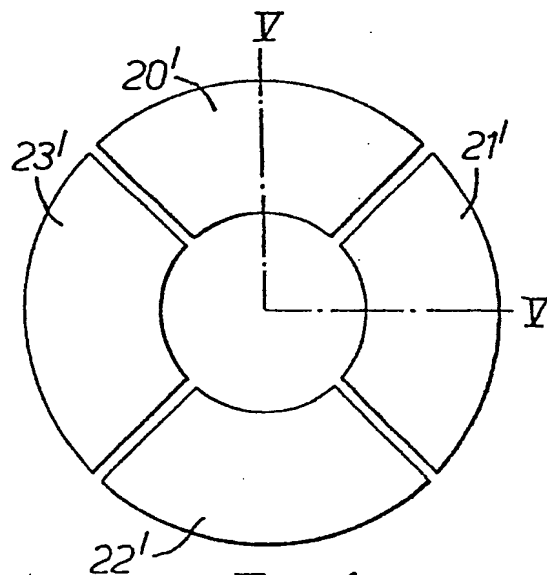


FIG. 4.

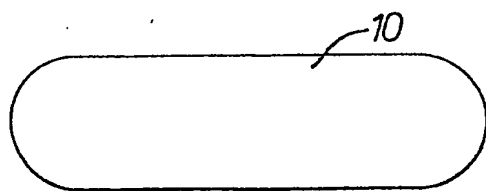


FIG. 3.

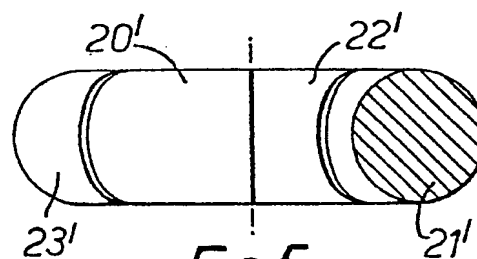


FIG. 5.

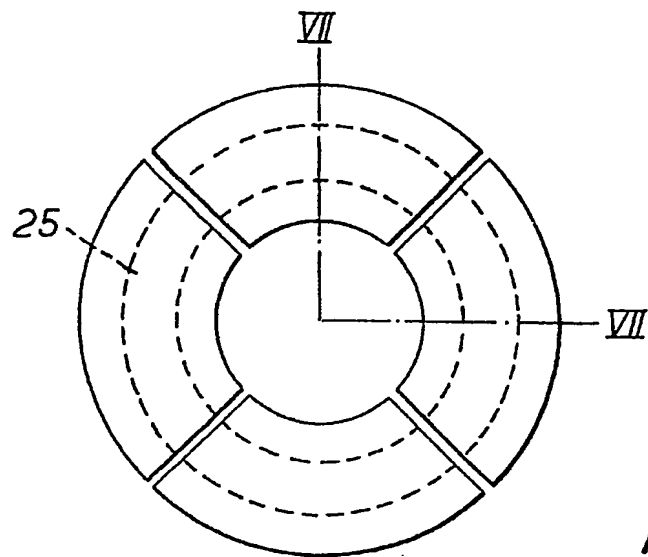


FIG. 6.

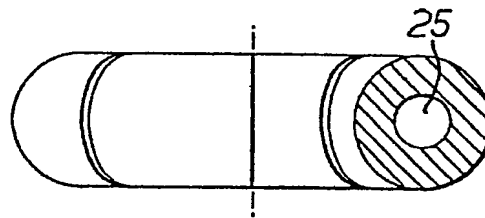


FIG. 7.

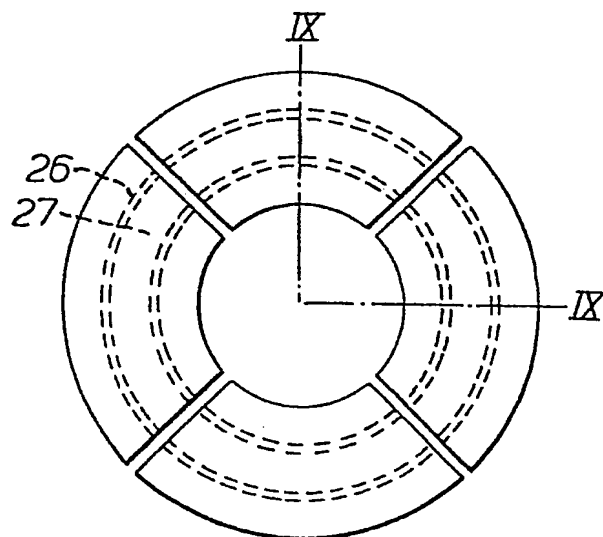


FIG. 8.

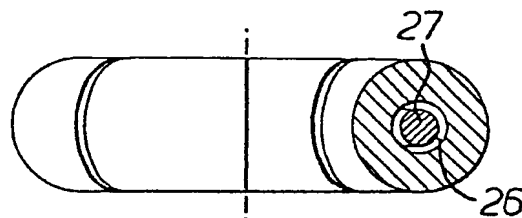


FIG. 9.



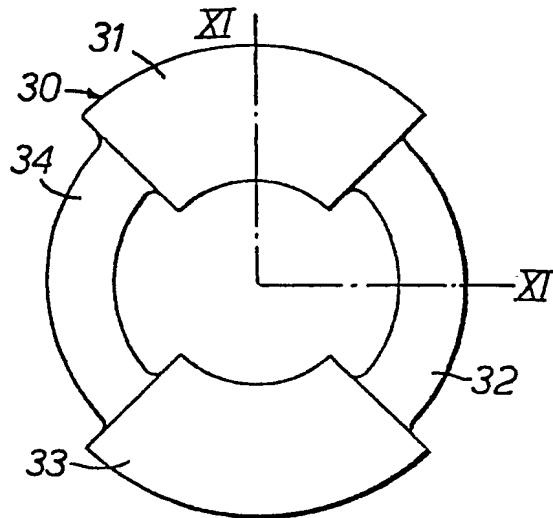


FIG. 10.

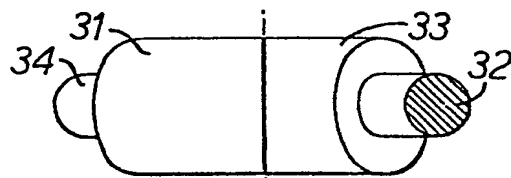


FIG. 11.

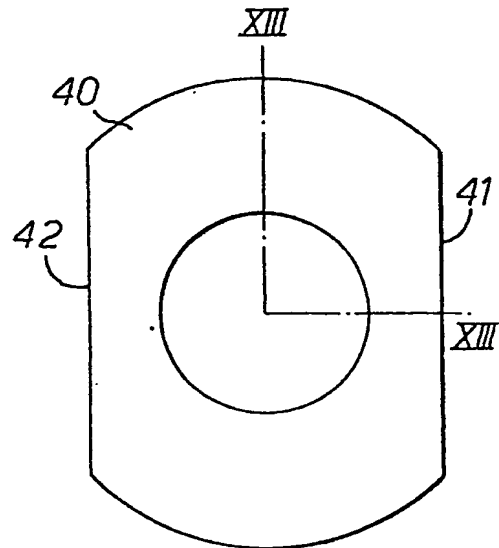


FIG. 12.

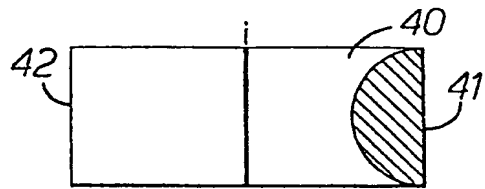


FIG. 13.

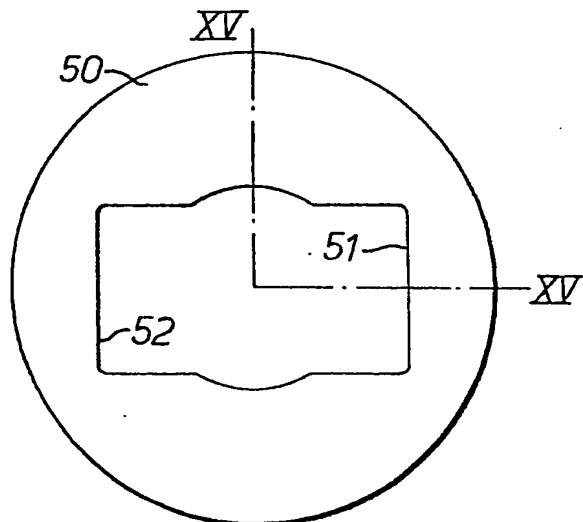


FIG. 14.

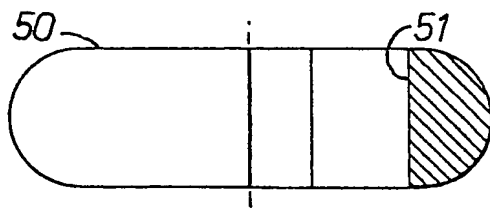


FIG. 15.



European Patent  
Office

# EUROPEAN SEARCH REPORT

0073119

Application number

EP 82 30 4187

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. <sup>3</sup> )
Y	<p>--- CH-A- 270 434 (SCHWEIZERISCHE LOKOMOTIV- UND MASCHINENFABRIK) * Page 1, lines 13-52; page 2, lines 1-92; figures 1,2 *</p>	1,2,5- 7,8-10	<p>B 61 F 5/30 B 60 G 11/54 F 16 F 1/38</p>
Y	<p>--- DE-A-2 537 172 (MAN)  * Page 1, paragraph 2; page 2, paragraph 3; page 4, paragraph 3 and 5 - page 5, paragraph 1; page 8, paragraph 2; figure 1 *</p>	1,2,8- 10	
A	<p>--- DE-B-1 038 416 (LEMFÖRDER METALLWAREN) * Column 1, lines 26-48; figures 1-4 *</p>	1-4	
D,A	<p>--- GB-A-1 508 632 (BRITISH RAILWAYS BOARD)  -----</p>		<p>TECHNICAL FIELDS SEARCHED (Int. Cl. <sup>3</sup>)</p> <p>B 61 F B 60 G F 16 F</p>
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15-11-1982	Examiner GROTZINGER J.P.
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons &amp; : member of the same patent family, corresponding document</p>			